natural & social environments
environmental determinism v. coupled systems
reconstructing environments
environmental archaeology
- chronology; abiotic (climate & geomorphology); biotic (flora & fauna)
measures
- temporal-spatial scales
global-scale
- ocean; isotopic; terrestrial
landscape-scale
- glacial; fresh water; sediments & soils; tree rings
floral: archaeobotany
- microbotany & macrobotany
faunal: zooarchaeology
- microfauna & macrofauna
coprolites & isotopes
human-modified:
- immediate & landscape
catchments
subsistence ("food quest")
- meals v. diet
  - identify, quantify & interpret
site formation processes
floral remains
- microbotany & macrobotany
other lines of evidence
faunal remains
- macro and microfauna
seasonality & domestication
human remains
- stomach contents; coprolites; disease; isotopes

reconstructing the human environment
all human groups have an impact on their environment
- e.g., Australian Aboriginal recreational fire starting
e.g., Easter Island deforestation
e.g., domestication of plants and animals

The site and its location are the most basic features of the human environment
important because people usually situate their sites in proximity to resources that are important to them
- water, stone or clay sources, food types, natural defensive features
sometimes sites are situated for reasons that are not empirically verifiable (the "nonempirical" world)
e.g., presence of malevolent spirits

modification of IMMEDIATE environment (the vicinity of the living area)
controlled use of fire by at least 500ka
modifications to natural shelters (caves); origins of domestic architecture
settlement fortifications

... wider environment (land management)
gardens and field systems
irrigation works
boundary walls
pollution of air, soil and water
management of woodland and vegetation

site catchment =
the total area from which the a site’s contents have been derived
- your household’s catchment is effectively global
- a small hunter gather camp may have a catchment with a radius of 10-20 km
reconstruction of catchment areas based on sourcing of materials
- identify the geological sources of where stone or clay raw materials have come from
- distance of transport

x-ray flourescence characterization of Olmec & geological bitumen

subsistence, meals and diets
- subsistence = the quest for food
  - analysis of strategies used to find, capture, extract, process, trade and consume foods
    - usually many different ways to accomplish the “food quest”, why were some strategies chosen and not others?
- meal = direct evidence of what people were eating at a particular time and place
- diet = the pattern of consumption over a period of time
- study of diets, provides information about…
  - nutrition
  - “foodways” → how people use food to communicate

Food & the Social and Ideological Realms

spirituality

status
- **evidence of meals**
  - historical accounts

- **depictions in various media**

- **preserved foodstuffs**
  - indirect evidence (that plants/animals were extracted/processed for food)
    - charred grain or seeds from cooking in an oven
    - cutmarks on bone or burned bone
    - food residues (lipids/proteins/DNA) in cooking or eating vessels and on tools
  - direct evidence
    - stomach contents (in well-preserved remains)

- **direct evidence**
  - coprolites ("fossil dung")
    - direct evidence of what an animal was eating
    - evidence of body size!

- **isotopic studies**
  - bones (and many other materials) preserve isotopic "signatures" of the foods that they eat

  - $^{13}$C/$^{12}$C ratio in bone indicates whether individuals ate domesticated grasses (C4 plant) or other carbon sources not related to grasses (C3 plant, marine resources)

  - $^{15}$N/$^{14}$N in bone: used to assess "trophic level"; ratio tends to get higher the farther up the trophic pyramid one is

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**Otzi’s last meal: venison and wheat**

**coprolite of a Miocene herbivore (23-5 mya)**

**mesolithic to neolithic shift in Britain ca. 5200 14C BP**
- evidence of diets
  - sum of meals = diet?
    - to what extent do the food remains at a site represent the total diet of the inhabitants?
  - things to consider? context, sample and preservation

- preservation of botanical remains (macrobotanical)
  - preservation usually best in “extreme” environments
    - very dry (desiccation), very wet (waterlogged), very cold (frozen)
  - or with burning
    - converts “reactive” organics to an inert material

- preservation of faunal remains
  - fast burial in sediments where chemistry most closely matches bone chemistry
    - e.g., alkaline sediments such as at salt lakes, or in shell middens

- evidence of diets
  - other issues surrounding analysis of plant and animal remains
    - did humans accumulate the plant and animal remains at a “site”?
      - many natural agencies other than humans (e.g., water flow, owls, hyenas) are known to accumulate bones
  - are the remains related to food quest?
    - some animal (and plants) may have been captured for resources not related to nutrition
      - e.g., leather, sinews, bones for fuel, fat for fuel or pigments, bone and antler for tools…
      - e.g., plant fibers for clothing, basketry, shelter, ropes…
  - requires careful attention to context and associations

- bones and teeth
  - malnutrition
    - stature
    - rickets
  - microscopic features
    - abrasions and wear on teeth that indicate foods in diet
  - tooth decay and loss
    - often associated with increase in starches and sugars in diet from the advent of agriculture

Neolithic mandible. Yikes!
analyzing diets
- identification of remains (classification)
  - attribution of preserved remains to a taxonomic group
  - comparative collection

quantify remains
- provide numerical counts of the frequencies of different foods
  - NOTE: fragments v. elements v. individuals

interpret remains
- provide a synthesis (theoretically grounded) of how diet was organized
  - e.g., is the diet “optimal” for balancing proteins and fats, or for limiting intake of toxins?

major avenues of subsistence analysis
- seasonality
  - how human groups adjust their subsistence strategies to deal with seasonal changes in the DISTRIBUTION, QUANTITY, and QUALITY of plant and animal resources
    - e.g., migratory game: follow or switch to another prey
    - e.g., growing seasons: plants may be abundant in some seasons but not others
    - e.g., animal weight: fat in some seasons skinny in others

- plant and animal domestication
  - how did humans manage to insert themselves into the reproductive cycle of different organisms
  - when did this occur: how do we identify an early domesticate
  - why did this occur: few other organisms have ever accomplished domestication!